

Claims:

1. A synthetic protein copolymer having selected plastic and elastic properties comprising at least one hydrophilic block and at least one hydrophobic block.
2. The protein copolymer of claim 1 having a first hydrophobic end block, a second hydrophobic end block, and a middle hydrophilic block, wherein said first and second end blocks are substantially identical.
3. The protein copolymer of claim 1 wherein the first end block comprises a nucleic acid sequence capable of encoding an amino acid sequence of $[\text{VPAVG}(\text{IPAVG})_4]_n$ or $[(\text{IPAVG})_4(\text{VPAVG})]_n$.
4. The protein copolymer of claim 3 wherein the middle block comprises a nucleic acid sequence capable of encoding an amino acid sequence selected from the group consisting of: $[(\text{VPGEG})(\text{VPGVG})_4]_m$, $[(\text{VPGVG})_4(\text{VPGEG})]_m$, and $[(\text{VPGVG})_2\text{VPGEG}(\text{VPGVG})_2]_m$.
5. The protein copolymer of claim 4 wherein n is from about 5 to about 100 and wherein m is from about 10 to about 100.
6. The protein copolymer of claim 5 wherein n is about 16.
7. The protein copolymer of claim 6 wherein the middle block is selected from the group consisting of: $\text{VPGVG} [\text{VPGVG}(\text{VPGIGVPGVG})_2]_{19}\text{VPGVG}$; $\text{VPGVG} [(\text{VPGVG})_2\text{VPGEG}(\text{VPGVG})_2]_{30}\text{VPGVG}$; $\text{VPGVG} [(\text{VPGVG})_2\text{VPGEG}(\text{VPGVG})_2]_{38}\text{VPGVG}$; $\text{VPGVG} [(\text{VPGVG})_2\text{VPGEG}(\text{VPGVG})_2]_{48}\text{VPGVG}$; $\text{VPGVG} [\text{VPGVG}(\text{VPNVG})_4]_{12}\text{VPGVG}$; $\text{VPGVG} [(\text{APGGVPGGAPGG})_2]_{23}\text{VPGVG}$; $\text{VPGVG} [(\text{APGGVPGGAPGG})_2]_{30}\text{VPGVG}$; $[\text{VPGVG}(\text{IPGVGVPGVG})_2]_{19}$; $[\text{VPGEG}(\text{VPGVG})_4]_{30}$; $[\text{VPGEG}(\text{VPGVG})_4]_{48}$; $[(\text{APGGVPGGAPGG})_2]_{22}$; and $[(\text{VPGMG})_5]_x$, wherein x is from about 10 to about 100.

8. The protein copolymer of claim 1 capable of elongation up to about 14 times its initial length.
9. The protein copolymer of claim 1 cast as a film.
10. The film of claim 9 comprising a plurality of layers.
11. The multi-layered film of claim 10 comprising a first layer and a second layer, wherein the first layer derives from a first polymer exposed to a first solvent, and the second layer derives from a second polymer exposed to a second solvent, thereby creating a film having a desired mechanical property.
12. The multi-layered film of claim 11 wherein the first polymer and the second polymer are substantially identical.
13. The multi-layered film of claim 11 wherein the first solvent enhances film elasticity and the second solvent enhances film plasticity.
14. The multi-layered film of claim 11 wherein the first solvent is water and the second solvent is trifluoroethanol.
15. The protein copolymer of claim 1 in gel form.
16. The protein copolymer of claim 1 in the form of a fiber or fiber network.
17. The fiber network of claim 16 comprising a first fiber and a second fiber, wherein the first fiber derives from a polymer exposed to a first solvent and the second fiber derives from a polymer exposed to a second solvent.
18. A method of generating a medical implant having a selected mechanical property comprising applying the fiber of claim 16 to the implant.
19. A method for producing a plastic elastic protein copolymer comprising the steps of
 - a. providing a first block of nucleic acid sequence, wherein said first block encodes a hydrophilic protein;

- b. providing a second block of nucleic acid sequence, wherein said second block encodes a hydrophobic protein;
 - c. synthesizing a nucleic acid molecule comprising said first and second blocks; and
 - d. expressing said nucleic acid molecule to produce said protein copolymer.
20. The method of claim 19 further comprising solubilizing said protein copolymer in a solvent, thereby creating a solution, and bringing said solution to a temperature to cause said copolymer to agglomerate to form a non-covalently crosslinked mass.
21. The method of claim 20 further comprising covalently crosslinking said polymer.
22. A method of delivery of a drug or biological agent via a stent, embolization coil, vascular graft, or other implanted biomedical device comprising the method of claim 20 and further comprising the steps of
- e. including the drug or biological agent in the solvent, thereby making a mixture with said copolymer; and
 - f. applying said mixture to said stent, embolization coil, vascular graft, or other implanted biomedical device.